Avoidance of fluoroscopy during radiofrequency ablation

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Introduction: Only few electrophysiology laboratories have demonstrated the feasibility and safety of minimizing fluoroscopy during catheter ablation procedures using 3-dimensional electroanatomical mapping system (3-D Map). It is not known whether these results can be reproduced by other centers and also if fluoroscopy can be completely avoided. This prospective study was designed to assess the safety and feasibility of non-fluoroscopic catheter ablation of tachyarrhythmias and to assess whether the simplified 'tagging only' approach instead of creating 3-D chamber anatomy may suffice.

Methods: During the period from March 2012 to December 2014, 364 patients underwent radiofrequency ablation procedure with the aid of 3-D map (The Ensite Velocity-Navx, St. Jude Medical). The procedures were performed under conscious sedation using right and if required left femoral vessels for access. The insertion and positioning of the catheters were performed under 3-D Map guidance using 2 simultaneous views, usually left anterior oblique and right anterior oblique, and one of the external skin patches as reference. The catheters were placed making gentle movements of advance until intracavitary electrograms are registered and were lodged in the desired position. Once the coronary sinus catheter is cannulated, the reference for the 3-D Map was changed to its distal tip. Two more 5F or 6F quadripolar diagnostic catheters were placed at the His bundle and the RV apex. A 7F deflectable duodecapolar (St. Jude Medical) was inserted in the right atrium when the clinical diagnosis was either atrial tachycardia or atrial flutter. A 6F decapolar catheter was inserted in the left ventricle when the diagnosis was ventricular tachycardia. A 6F or a 7F deflectable ablation catheter was used. No attempts were made to create 3-D chamber anatomy when the diagnosis was other than atrial tachyarrhythmias (AT, AF or AFL) and VT (except idiopathic left ventricular fascicular tachycardia). Instead, only the points of interest based on electrogram were tagged ('tagging only' approach). Fluoroscopy was deliberately avoided unless absolutely necessary. The feasibility, efficacy, safety and the procedural time of catheter positioning and ablation without fluoroscopy were analyzed.

Results: A total of 364 patients underwent radiofrequency ablation using 3-D map. Without fluoroscopy, the entry of catheters into the right heart was achieved in 87% ($n = 317$) patients with mean time of 1.7 ± 0.3 min. The CS cannulation without fluoroscopy was possible in 84% ($n = 306$) of patients with the mean time of 1.9 ± 0.6 min. 116 (32%) patients were excluded from the study upon electrophysiological diagnosis of SVT from left side ($n = 52$), atrial fibrillation ($n = 6$), atrial flutter ($n = 21$), RVOT VT ($n = 13$) and Scar VT ($n = 24$). The exclusion was based on the need for fluoroscopy. The incidence of ablation without fluoroscopy and procedural time for each arrhythmia are shown in Table 1. Fluoroscopy was resorted to only when resistance was felt while advancing catheters to the desired position or when there was suspicion of tamponade or failure to achieve noninducibility of tachycardia. There were no complications during catheter advancement to the heart. However, four patients (1.2%) developed cardiac tamponade during intracardiac catheter manipulation.

Conclusion: Our results reaffirm the feasibility, safety and efficacy of non-fluoroscopic ablation for some of the tachyarrhythmias with the aid of 3-D map which provides the luxury of two simultaneous views all the time during the procedure. The simplified 'tagging only' method is adequate for safer and effective ablation in AVNRT, right sided accessory pathways including Mahaim and ILVT.

Table 1 – Feasibility of non-fluoroscopic ablation. ILVT – idiopathic left ventricular tachycardia (left posterior fascicular tachycardia).

Arrhythmia	Total no. of cases (*n*)	Ablations without fluoroscopy (*n*)	Mean procedure time (min)
AVNRT	177	156 (88%)	36 ± 7.5
Right sided Accessory pathway	52	18 (34%)	40 ± 7.8
ILVT	12	4 (36%)	84 ± 23
Mahaim pathway	7	2 (33%)	55 ± 21.6

Successful ablation of atrial flutter in an adult patient post TOF repair

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Introduction:

- TOF is the most common congenital heart disease requiring intervention in first year of life. Amounts to 10% of all congenital heart disease.
- Initial surgical management was palliative shunts–Blalock/Taussig first done in 1944.
- Total surgical repair started as early as 1954 by Walton Lillehei et al.
- **Current era:** Total repair performed in infancy with <2% mortality and 85–90% long-term survival. This adds to the ever growing list of adult patients post TOF repair who are prone for various arrhythmias.

Case report:

- 51-year-old gentleman
- Status post surgical repair for TOF – 1981 (at age 17 years)
- **Current complaints:** Palpitations for two years, increased for past six months.
- **Evaluated in 2013:** Atrial flutter a DC Cardioverted. Transiently in sinus rhythm and reverted to flutter again.
- **On medication:** T. Metoprolol succinate 50 mg once daily and T. Flecainide 50 mg twice daily.
- Offered radiofrequency ablation in view of worsening symptoms and poor response to medication.
- **Baseline ECG:** Atrial flutter with 3:1 AV block; F waves at rate 250/min; Righ bundle branch block
- NaVX 3D mapping showed a typical cavotricuspid isthmus dependent atrial flutter counterclockwise activation and posterolateral scar in the right atrium. Transjugular route used for ablation due to difficulty in access to intended area via transfemoral approach.

Discussion:

- As the post-operative TOF patient grows older arrhythmia and heart failure are the predominant problems which need prompt therapy.

- Late mortality almost always related to heart failure or ventricular tachycardia.
- Atrial arrhythmias as a group contribute to the most commonly encountered rhythm abnormalities – 20%. Various reasons for atrial arrhythmias include: atrial dilatation/stretch; post operative scar; RV dysfunction; scar tissue resulting from cannulation of IVC/SVC for cardiopulmonary bypass.
- RBBB seen commonly in postoperative cases. Supraventricular tachyarrhythmias therefore tend to have broad QRS complexes with RBBB morphology.
- LBBB morphology tachycardia suggestive of ventricular tachycardias.
- Treatment options for arrhythmias include: Catheter guided ablation; intraoperative cryoablation; pulmonary valve replacement (shown to reduce ventricular arrhythmias); ICD implantation.

Implication to clinical practice:

- Post-operative corrected TOF patients increasingly encountered in current cardiology practice.
- Radiofrequency ablation needs to be the initial therapeutic option for any sustained arrhythmia.
- Distorted anatomy may complicate the accessibility of pathway through femoral route; transjugular route is useful alternative.
- Heart failure and arrhythmia–two most common problems in post-operative TOF patients, perpetuate each other and hence need prompt therapy.

Ectopic atrial tachycardia in congenital complete heart block

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Introduction:

- Congenital complete heart block seen 1 in 15000–20000 live births.
- Most common cause is neonatal lupus resulting form maternal anti-Ro/La antibodies crossing transplacentally.
- Other causes include fetal myocarditis, structural heart diseases (CCTGV) and familial conduction system diseases.
- Fetal and neonatal CHB often symptomatic – hydrops fetalis, congestive cardiac failure.
- Childhood and adolescent cases often tend to by asymptomatic and incidentally diagnosed.
- Pacemaker indicated at the earliest in presence of symptoms (class I), and even prophylactically in all individuals with CHB (Class IIa).

Case report:

- 25-year-old lady presented with effort intolerance for the past two years.
- There was no history of syncope/palpitations.
- ECG: Showed sinus rhythm with complete heart block. P wave rate was ~130/min.
- ECHO: Normal LV systolic function; LVIDd = 4.8 cm; LVIDs = 3.4 cm.
- TMT: Maximum heart rate 90/min; Chronotropic incompetence present.
- A permanent pacemaker implantation was done on 22/6/2014: St. Jude Verity DDDR pacemaker
- Presented one year post pacemaker implantation for general checkup – persistence of exertional fatigue.
- ECG at follow up: Atrial sensed, ventricular paced complexes at a rate of 120/min.
- ECHO at follow up: Moderate LV systolic dysfunction – LVEF = 33%; LVIDd = 6.3 cm; LVIDs = 5.3 cm.
- Final impression: Tachycardiomyopathy due to underlying atrial tachycardia.
- Patient was advised electrophysiology study with radiofrequency ablation of the ectopic atrial tachycardia focus, however, wished to return for the same at a later date. Her pacemaker mode was changed to VVI at a base rate of 60/min and advised to follow up within three months for a radiofrequency ablation.

Discussion:

- Baseline ECG at presentation showed complete heart with P wave rate of 120–130/min. On closer look the morphology of P wave was not identical to the sinus rhythm.
- P wave in lead V1 was positive and narrow (40 ms). P wave in leads II, III and aVF was positive thereby suggesting a possible focus in the crista terminalis or right pulmonary vein.
- Tachycardiomyopathy results from persistent high heart rate and is often treatable by eliminating the tachycardia thereby bears very good prognosis.
- Pacemaker mediated tachycardia results mainly from two major causes: Inappropriate tracking of the atrial tachyarrhythmias or endless loop tachycardia (ELT).
- ELT can be treated by prolonging the post ventricular atrial refractory period (PVARP), decreasing the upper tracking rate and also by changing the pacemaker to single chamber mode (VVI, AAI or VAI). Alternatively atrial sensitivity can be reprogrammed however this bears the risk of atrial under-sensing and thereby leads to additional atrial pacing.
- Atrial tachyarrhythmias resulting in inappropriate tachycardia are best treated with radiofrequency ablation of arrhythmias.

Implication to clinical practice:

- Congenital complete heart block is a rare entity and is often picked up in fetal/neonatal period.
- Morphology of P wave on ECG is important to distinguish from sinus to ectopic atrial tachycardia at high rates.
- Presence of complete heart block protected the patient from deleterious effects of atrial tachycardia.
- Tachycardiomyopathy bears a good prognosis and is often reversible once the tachycardia is completely eliminated.

Effect of pacemaker lead implantation on tricuspid valve and right ventricular function

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Introduction: Trivial tricuspid regurgitation (TR) is a common echocardiographic finding in healthy individuals. However, significant TR (grade ≥2) has been shown to be associated with poor prognosis, regardless of the underlying cardiac pathology. Placement of an RV (trans-tricuspid) lead has also been associated with a higher risk of TR. However, the exact incidence of lead-induced